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ABSTRACT

The efficacy of second dentition, the number of erupted teeth, as an index in assessing school readiness was examined. A series of cognitive, achievement, and social-emotional instruments were administered to a group of 41 first- and 43 second-grade children. The tests used in this study were: Devereux Elementary School Behavior Rating Scale, Metropolitan Readiness Tests, Concept Assessment Kit-Conservation, and Gates-MacGinitie Reading Tests. Scores on these instruments were correlated with the number of erupted second teeth, as determined by a dental hygienist and with chronological age (in months). Second dentition scores were shown to be a far better correlate of overall school readiness than was chronological age. Specifically, second dentition was a useful supplementary readiness index for first-grade boys. The data suggest the importance of biological indices of development in assessing school readiness. Additional areas for future research relating to second dentition were discussed. (Author/CTM)

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SECOND DENTITION AS A SUPPLEMENTARY INDEX OF SCHOOL READINESS

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Abstract

The efficacy of second dentition as an index in assessing school readiness was examined. A series of cognitive, achievement, and social-emotional instruments were administered to a group of 41 first- and 43 second-grade children. Scores on these instruments were correlated with the number of erupted second teeth, as determined by a dental hygienist and with chronological age (in months). Second dentition scores were shown to be a far better correlate of overall school readiness than was chronological age. Specifically, second dentition was a useful supplementary readiness index for first-grade boys. The data suggest the importance of biological indices of development in assessing school readiness. Additional areas for future research relating to second dentition were discussed.

SECOND DENTITION AS A SUPPLEMENTARY INDEX OF SCHOOL READINESS

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One of the major contemporary concerns among educators is the question of when is the appropriate time for learners to commence schooling. While some believe that early school entrance is desirable in order to take advantage of the strong motivation for learning in young children, others believe that there are certain readiness levels, both psychological and physical, which should be attained by the child prior to school entrance, and that it is harmful for a child to begin school too early. The present investigation sought to examine the importance of a physical readiness factor which has received limited attention from behavioral science researchers in the past; the factor of second dentition, the eruption of the permanent teeth.

There is increasing evidence that the measure of second dentition may be a potentially important index of school readiness. Research by Ilg and Ames (1964) was the first to examine systematically the importance of second dentition as a readiness factor. Their extensive examination of 80 primary grade children suggested a distinct pattern of relationship between second dentition and school performance. Children who were ahead of schedule on second-tooth eruption were likely to be rated as being in the top group or doing well by their teachers, while children behind schedule on second-tooth eruption were generally given low ratings on their academic progress. Ilg and Ames concluded from their research that:

> We ourselves have become rather self-conscious at the mere mention of teeth, because so many people believe strongly that there is no relationship between structure and behavior, between for instance, a child's behavior in school and his teething. But our clinical evidence has been piling up over the years to the point that we are convinced that a definitive study should be made of this relationship (Ilg and Ames, 1964, p. 237).

While research by Baust (1976) found no relationship between eruption of the permanent teeth and school achievement among primary-level students, Rosen (1970) found that end-of-kindergarten scores on the Gesell School Readiness Tests were related to the number of erupted second teeth for boys, but not for girls. Further, support for the importance of second dentition and school readiness comes from the educational theory of Rudolf Steiner, founder of the Waldorf Schools of Europe and the United States. Steiner (1968) believed that loss of the primary teeth was an important developmental milestone for the cognitive developmental process. Many Waldorf Schools today consider the criterion of dental development as a factor in admitting children into their schools.

Another connection between second dentition and school readiness can be seen by examining the relationship of brain and skull development to shifts in levels of cognitive development. An extensive review of research on periods of brain and skull development by Epstein (1974) demonstrated that the greatest increments in brain weight and skull circumference occurs during the biennial period of six to eight years of age. This spurt coincides with the development of concrete operational thought as described by Piaget and with the development of increased visual and auditory

discrimination, necessary prerequisites for reading skills. Since second dentition is a biological correlate of skull development, the research of Epstein reinforces the theoretical link between second dentition and learning readiness.

The present investigation sought to test the hypothesis that children with more advanced second-tooth eruption would show higher levels of performance on measures related to school readiness than children with fewer second teeth. Specifically, the following predictions were in order:

1. Cognitive development will be positively correlated with second dentition.
2. Social-emotional development will be correlated with second dentition, with the direction of the correlation dependent upon the type of behavior trait studied.
3. Reading ability will be positively correlated with second dentition.

METHOD

Subjects

There were a total of 84 children in the study; 41 first-grade children including 19 boys and 22 girls, and 43 second-grade children including 26 boys and 17 girls. The children were from predominantly middle-class families from a small city in western New York State. The mean age for all children was 87.7 months (s.d. = 7.88 months). Six additional children were initially involved in the study but were later deleted from the results due to transfer out of the school.

Procedures

Each child was given a complete dental examination in October of the school year by a licensed school dental hygienist as part of a biannual dental examination in the participating school system. In addition, the hygienist indicated on a dental chart the total number of second teeth which had erupted* (including missing second teeth) for each child. Following the dental examinations and ratings, the experimenter assigned total second dentition scores to each child. The second dentition scores were consistent with the second dentition norms obtained by Carlos and Gittelsohn (1965).

Each of the four classroom teachers in the study was then asked to complete the Devereux Elementary School Behavior Rating Scale (DESB) (Spivack & Swift, 1967) for each child in the class. The DESB is a measure of overt social and emotional behaviors which either interfere with or enhance school learning. The DESB measures 11 different behavior factors and three non-factor items. Following completion of the DESB ratings, the teachers administered the Metropolitan Readiness Tests (Hildreth, Griffiths & McGouvran, 1965), a measure of whether or not a child possesses the intellectual skills needed for school learning. The Metropolitan Readiness Tests consist of six sub-test skill areas. Two weeks after the Metropolitan Readiness Tests were given, each child was individually given a test of cognitive development known as the Concept Assessment Kit-Conservation (Goldschmid & Bentler, 1968). The Concept Assessment Kit

*Eruption was defined as when a tooth had penetrated the gingivae (gums) and entered into the oral cavity.

measures the ability of the child to judge about the relative quantity of two objects, which perceptually appear to differ. The principle of conservation was developed by the noted Swiss psychologist, Jean Piaget, and is a widely accepted index of cognitive development. The Concept Assessment Kit consists of six sub-tests which tap different types of conservation ability. In addition to the three tests described above, data were obtained from school records during the following June for the Gates-MacGinitie Reading Tests (Gates & MacGinitie, 1965), a measure of reading vocabulary and reading comprehension. There are pre- and posttest scores (October and June) for all measures except the Gates tests, for which there are posttest scores only.

RESULTS

Pearson correlations were computed for second dentition scores and chronological age (in months) with scores obtained from the 58 dependent variables involving sub-test and total test scores from the four instruments previously described. When first analyzed by grade level, second dentition was significantly correlated (at the .05 level or below) with 13 of the 58 variables for the first-grade children. Among the more important correlations with second dentition was total posttest score for the Concept Assessment Conservation tasks and total posttest scores on the Metropolitan Readiness Tests. Only six of the 58 correlations were significant for the first-grade children when chronological age was the correlate, including total pretest score for the Concept Assessment Conservation tasks. For second-grade children, neither second dentition nor chronological age was significantly correlated, in the predicted direction, with any of the 58 dependent variables.

In order to examine the data more stringently for the first-grade children, separate correlations were computed for boys and girls, in order to determine the extent of suspected sex differences in rates of second dentition and readiness levels. The correlational analyses for first-grade boys are presented in Table 1 and Table 2. By inspection of the pretest correlations in Table 1, it can be seen that second dentition was significantly correlated with three of the six conservation sub-tests and with the total conservation score. On the Devereux Scale, dentition was negatively correlated with eight of fourteen teacher ratings of undesirable classroom behaviors, suggesting that the greater the number of second teeth, the fewer the number of perceived behavior problems. On the Metropolitan Readiness Tests, second dentition was significantly correlated with four of the six skill area scores and with the total readiness score, indicating that first-grade boys with a greater number of second teeth have a higher level of skills important for school learning.

Table 2 indicates the long-term (posttest) relationship of second dentition to readiness measures. For the conservation measures, all six sub-tests and the total score were significantly correlated with dentition scores. On the Devereux Scale, five factors were negatively correlated with dentition, as predicted. On the Metropolitan Readiness Tests, second dentition was again correlated with four of the six skill areas scores and with the total readiness score. Finally, and most notable, second dentition was significantly correlated with reading comprehension and total reading ability as measured by the Gates-MacGinitie Reading Tests.

The correlational analyses for first-grade girls did not yield any consistent trends in support of the stated hypotheses. Also, neither chronological nor second dentition was a significant correlate with the readiness variables for second-grade boys or girls.

DISCUSSION

The results of the present study are partially supportive of the Ilg and Ames findings that second dentition is related to school readiness and performance in the primary grades. For first-grade boys, number of erupted second teeth appears to be a valuable supplementary index of school readiness. Since boys tend to experience more difficulty in the primary grades than do girls, the additional information about a child provided by the second dentition factor should be welcomed by teachers, school administrators, and psychological services personnel. The problem inherent in the discussion of the study results is that, since second dentition does not usually begin until the age of six, the information provided by second dentition may be available too late to be of preventative value, since many boys will have completed kindergarten or entered first grade by their sixth birthday. However, if second dentition could be recorded subsequent to the sixth birthday, the obtained information may be useful in decisions concerning boys with learning or behavior problems. Decisions such as whether or not to retain a child in first grade, the need for specific remedial efforts for a child, or decisions regarding placing the child in a pre-first-grade setting would all be enhanced to some degree, by second dentition information.

That the results were not significant for first-grade girls is important to note. These results are similar to those obtained by Rosen, which was discussed earlier. It may be that there is a basic sex difference in which dentition is simply not as important in the early learning processes of girls as it is for boys. It has also been demonstrated (Carlus and Gittelsohn, 1965) that second dentition occurs about three months earlier per tooth for girls than for boys. Although, in the present study, there was no significant sex difference in number of second teeth, the variation in dentition scores among boys was twice that of the dentition scores for girls, possibly resulting in a restriction on the magnitude of the correlations computed. Additional research with a sample of girls with a greater range of second dentition scores may be appropriate.

The lack of significant correlations for second-grade children can be largely attributed to the fact that second graders tended to reach the test ceiling; that is, the majority scored high on the instruments used and thus reduced the chances of obtaining high correlations with either dentition or chronological age.

The results of this investigation suggest the need for additional research with the second dentition factor. The focus of this research should center on two important questions. First, are deviations from the normal pattern of second-tooth eruption indicative of potential school learning problems? Second, is the eruption of a particular type of tooth or teeth, such as the lateral incisors or upper first molars, of greater importance in predicting primary grade school performance than that of other second teeth. Replications of the present study with a larger and more diverse sample and an examination of the two concerns expressed above are in order.

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TABLE 1

Significant Pre-Test Correlations for First-Grade Boys (n = 19) Between Number of Second Teeth and School Readiness Measures

Readiness Measure	r	p
Concept Assessment Kit-Conservation		
Number	+.37	.06
Substance	+.46	.025
Discontinuous Quantity	+.54	.008
Total Score Conservation	+.44	.03
Devereux Elementary School Behavior Rating Scale		
Impatience	-.45	.026
External Blame	-.36	.064
Achievement Anxiety	-.38	.052
External Reliance	-.40	.046
Creative Initiative	-.34	.074
Irrelevant Responsiveness	-.43	.032
Unable to Change	-.53	.01
Quits	-.51	.012
Metropolitan Readiness Tests		
Listening	+.45	.026
Matching	+.33	.082
Number	+.38	.052
Copying	+.41	.022
Total Score-Readiness	+.37	.059

TABLE 2

Significant Post-Test Correlations for First-Grade Boys (n - 19) Between Number of Second Teeth and School Readiness Measures

Readiness Measure	r	p
Concept Assessment Kit-Conservation		
Two Dimensional Space	+.51	.013
Number	+.47	.022
Substance	+.53	.009
Continuous Quantity	+.33	.083
Weight	+.50	.015
Discontinuous Quantity	+.55	.007
Total Score-Conservation	+.56	.006
Devereux Elementary School Behavior Rating Scale		
Classroom Disturbance	-.40	.043
Disrespect-Defiance	-.32	.088
External Blame	-.39	.05
Irrelevant Responsiveness	-.40	.046
Unable to Change	-.40	.044
Metropolitan Readiness Tests		
Listening	+.38	.052
Alphabet	-.44	.028
Number	+.40	.043
Copying	+.38	.055
Total Score-Readiness	+.47	.02
Gates-MacGinitie Reading Tests		
Comprehension	+.44	.031
Total Score-Reading	+.36	.063